SIEMENS

SICAM P35
SICAM P36
3-phase Multi-Function Power Meter

V1.10

Manual

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E50417-H8940-C562-2

Note

For safety purposes, please note instructions and warnings in the Preface.

Disclaimer of Liability

We have checked the contents of this manual against the hardware and software described. However, deviations from the description cannot be completely ruled out, so that no liability can be accepted for any errors or omissions contained in the information given.

The information given in this document is reviewed regularly and any necessary corrections will be included in subsequent editions. We appreciate any suggested improvements.

We reserve the right to make technical improvements without notice.

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Siemens Ltd.

Order No.: E50417-H8940-C562-2

Preface

Purpose of this manual

This manual describes the functions, operation, installation, and commissioning of devices 3-phase Current Power Meter-> In particular, one will find:

- Information regarding the configuration of the scope of the device and a description of the device functions > Chapter 3;
- Instructions for Operation and Display > Chapter 4;
- Technical Data > Chapter 2;

Target Audience

Protection engineers, commissioning engineers, personnel concerned with adjustment, checking, and service of selective protective equipment, automatic and control facilities, and personnel of electrical facilities and power plants.

Additional Support

Should further information on the System SICAM be desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, the matter should be referred to the local Siemens representative.

Our Customer Support Center provides a 24-hour service.

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Safety Information

This manual does not constitute a complete index of all required safety measures for operation of the equipment (module, device), as special operational conditions may require additional measures. However, it comprises important information that should be noted for purposes of personal safety as well as avoiding material damage. Information that is highlighted by means of a warning triangle and according to the degree of danger, is illustrated as follows.

DANGER!

Danger indicates that death, severe personal injury or substantial material damage will result if proper precautions are not taken.

WARNING!

Indicates that death, severe personal injury or substantial property damage may result if proper precautions are not taken.

Caution!

Indicates that minor personal injury or property damage may result if proper precautions are not taken. This particularly applies to damage to or within the device itself and consequential damage thereof.

Note

Indicates information on the device, handling of the device, or the respective part of the instruction manual which is important to be noted.

WARNING!

Qualified Personnel

Commissioning and operation of the equipment (module, device) as set out in this manual may only be carried out by qualified personnel. Qualified personnel in terms of the technical safety information as set out in this manual are persons who are authorized to commission, activate, to ground and to designate devices, systems and electrical circuits in accordance with the safety standards.

Use as prescribed

The operational equipment (device, module) may only be used for such applications as set out in the catalogue and the technical description, and only in combination with third-party equipment recommended or approved by Siemens.

The successful and safe operation of the device is dependent on proper handling, storage, installation, operation, and maintenance.

When operating an electrical equipment, certain parts of the device are inevitably subject to dangerous voltage. Severe personal injury or property damage may result if the device is not handled properly.

Before any connections are made, the device must be grounded to the ground terminal.

All circuit components connected to the voltage supply may be subject to dangerous voltage.

Dangerous voltage may be present in the device even after the power supply voltage has been removed (capacitors can still be charged).

Operational equipment with exposed current transformer circuits may not be operated.

The limit values as specified in this manual or in the operating instructions may not be exceeded. This aspect must also be observed during testing and commissioning.

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Overview 1

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1.1 Introduction

SICAM P35 and SICAM P36 3-phase electronic multi-function power meters integrate measurement, power metering, remote communication and control, large screen LCD and communication functions. It is designed for measuring power grid parameters such as voltage, current, power, power factor and frequency and metering active and reactive power. RS485 communication support MODBUS-RTU communication protocol. Binary input and output functions are optional.

This product is extensively applicable to power substation and distribution automation system, industrial control and industrial automation system, energy management system and community power monitoring, etc.

This 3-phase electronic multi-function power meter meets following standards:

- IEC 62052-11:2003 (Electricity metering equipment (a.c.) General requirements, tests and test conditions-Part 11: Metering equipment) standard
- IEC 62053-22:2003 static meters for active energy (classes 0.2 S and 0.5 S)
- IEC 62053-23:2003 static meters for reactive energy (classes 2 and 3)
- Modbus-RTU

1.2 Features

This project uses high-precision sampling and metering unit and high-speed MCU data processing unit, supporting high-precision, wide-range and accurate measurement and quick data analysis; segmented multi-line WVA LCD, realizing various and abundant display; white backlight for LCD, satisfying the need for viewing data in dark environment; NVM, supporting long-time data storage without data loss even in the event of power failure; RS485 communication port and industrial standard communication protocols, realizing flexible and reliable communication.

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2.1 Technical Data

Item		Technical Data
Product standard		IEC61557-12:2007
Input connection		3-phase-3-wire, 3-phase-4-wire, single phase
Measurement	Voltage	Reference voltage U_n: AC380 V, AC220 V, AC100 V, AC57.7 V Measuring range: 10 V ... 264 V phase voltage Maximum measuring range: 400 V phase voltage Power consumption: < 0.05 VA (single phase) Accuracy: RMS 0.2% Resolution: 0.01 V
	Current	Rated current I_n: 1 A, 5 A Measuring range: 0.015 A ... 6 A Maximum measuring range: 9 A Power consumption: < 0.05 VA (single rated current) Accuracy: RMS 0.2% Resolution: 0.001 A
	Power (active, reactive, apparent)	Accuracy: 0.2% Resolution: 0.001 kW/kVar/kVA
	Power grid frequency	Measuring range: 45 Hz ... 65 Hz Accuracy: 0.2% Resolution: 0.01 Hz
Metering	Active power	Accuracy level: 0.5 S, Acc. To IEC 62053-22 Resolution: 0.01 kWh, 5000 imp/kWh
	Reactive power	Accuracy: Class 2, Acc. To IEC 62053-23 Resolution: 0.01 kvarh, 5000 imp/kvarh
Digital signal	Power pulse output	2 electric energy (active and reactive) pulse outputs Opto-coupler isolation, 4,000 V_{RMS}
	Binary output (optional)	2 electromagnetic relay output Normal Open Contact Contact capacity: AC 250 V /3 A, DC 30 V /3 A
	Binary input (optional)	4 dry contact inputs Opto-coupler isolation, 4,000 V_{RMS}
Communication	RS-485 port	Interface type: Twisted Pair, Half Duplex Transmission Communication rate: 600 bps ... 38,400 bps Protocol: Modbus-RTU
Environment	Operating temp.	-25 ℃ ... +60 ℃
	Operating temp. limit	-35 ℃ ... +70 ℃
	Relative humidity	≤ 95% (condensation free)

Item		Technical Data
Others	Operating power supply	AC or DC power supply Max. input range: 40 V ... 420 V Power consumption: ≤ 1 W, 2 VA
	Dimension	Overall dimension (mm): 96×96×95 Panel cut out size (mm): 92×92
	Weight	Approx. 450 g

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3.1 Measurement

This meter is provided with various measuring functions. Power grid parameters and index measurable are as follows:

- voltage of each phase and mean voltage
- voltage of each line and mean voltage
- current of each phase, average current and neutral current
- overall and separate active power, reactive power and apparent power of each phase
- phase angle of voltage and current of each phase
- overall and separate power factor of each phase
- power grid frequency and measuring range 45Hz to 65 Hz

3.2 Energy Metering

This meter can meter various energy data:

- combined active and supply and demand active energy
- combined reactive and four-quadrant reactive energy
- supply and demand active energy of each phase and combined reactive energy of each phase

3.3 Limit violation Alarm

1. This product is provided with limit violation alarm function. User may select from voltage, current, power, power factor and frequency parameters at most 6 data groups at the same time as detection object and set upper and lower limits and judgment condition for them. Alarm will be activated when measured value is over the set limit. This product is provided with 2 relay outputs. When alarm parameters are configured that output is made from certain relay which is at automatic mode (not manual), limit violation alarm signal can be output through such relay (relay closing).

2. At most 6 limit violation alarm parameters can be set at the same time within the product. Configuration flow of each limit violation alarm parameter: select type of detected data-set threshold of detected data-set judgment condition-select output relay for alarm signal.

   • Code of various detected data: (hexadecimal number for Modbus-RTU code)

MODBUS code	Content of data	MODBUS code	Content of data
00	Phase A power factor	14	Phase A active power
01	Phase B power factor	15	Phase B active power
02	Phase C power factor	16	Phase C active power
03	Total power factor	17	Total active power
06	Frequency	18	Phase A reactive power
07	Phase A voltage	19	Phase B reactive power
08	Phase B voltage	1A	Phase C reactive power
09	Phase C voltage	1B	Total reactive power
0B	Uab line voltage	1C	Phase A apparent power
0C	Ubc line voltage	1D	Phase B apparent power
0D	Uca line voltage	1E	Phase C apparent power
0F	Phase A current	1F	Total phase apparent power
10	Phase B current		
11	Phase C current		
12	Neutral current		

When code of detected data is FF, limit violation alarm function of such group is off.

- Threshold of detected data: threshold judging whether detected value is out of limit; Different units for different data types: such as voltage-V, current-A, active-KW, reactive power-KVAR, apparent-KVA, frequency-Hz.
- Judging condition: 0 means alarm activated when exceeding limit; 1 means alarm activated when falling below limit.
- Alarm signal output relay: 0 means no alarm signal output; 1 means alarm signal outputted from relay1;2 means alarm signal outputted from relay 2; 3 means alarm signal outputted from relay 1 and relay 2 at the same time. .

3. Example of alarm parameter setting. Set one limit violation alarm parameter to automatic detection and alarm for "Phase A voltage", assuming that alarm threshold is 240 V, judging criterion is "over limit" and signal is outputted from relay 2.

   Use MODBUS RTU protocol to set alarm parameter: set 0110 address to "07", 0111 to "0000", 0112 to "5DC0" (multiply "240" by 100 to generate "24,000" and convert it into "00005DC0"), 0113 to "00" and 0114 to "02".

3.4 Display and Buttons

This product uses large-screen WVA multi-line LCD to provide visual and various display. The screen is provided with white backlight, enabling clear display in dark environment. Specific data information can be obtained through display with button operation. For details, see Chapter Operation and Display.

3.5 Communication

RS485 port is provided for parameter setting and reading of various data. For specific description, see Chapter Communication.

3.6 Permission and Security Management

1. This product is provided with programming permission management function.
   - L0 password: used for meter reset, setting all parameters and modifying L0, L2 and L4 passwords;
   - L2 password: used for meter reset, setting all parameters and modifying L2 and L4 passwords;
   - L4 password: used for parameter setting and modifying L4 password, not for meter reset, clearing extreme values and PT/CT ratio setting.
   - **All level default PASSWORD is "000000"**
2. Parameter setting is available only when this product is in programmable state. Steps for entering programming state: press " ↵ " and " ↱ " at the same time to enter "PASS" screen; input correct password and press " ↵ " to enter "SET" screen and enable programmable state. After entering programmable state, programmable state prompt appears on the bottom right corner of LCD. Programmable state will remain valid in 10 minutes after program button is pressed and become invalid after power down.
3. If incorrect password is used to set this product continuously (including communication setting and button programming) up to specific number of times (factory default 5 times), parameter setting function will be locked (factory default 60 minutes). Error count will be reset after setting once using correct password if such count is less than specific limit. Error count of password and lock time can be set (available in factory state).

3.7 Digital Input and Output Interface

Power Pulse Output

This meter provides two power pulse outputs: active and reactive, with internal opto-isolation, pulse output width (80±20) ms, maximum allowable passing current 10 mA (DC) and operating voltage range 5 V to 80 V (DC).

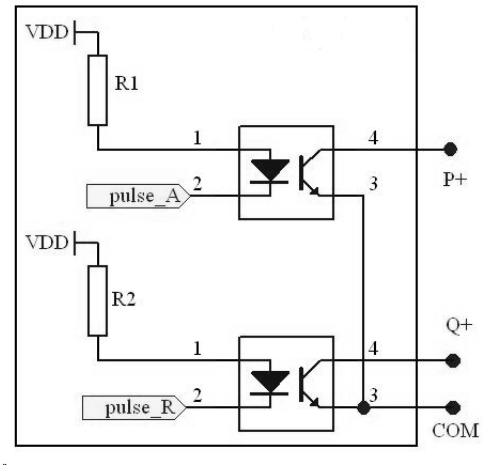

Figure 3-1 Circuit Diagram of Power Pulse Output Interface

Binary Input Interface

This product is provided with 4-digit binary inputs interface based on passive dry contact. Terminals are identified as DI1, DI2, DI3, DI4 and COM. COM is the common terminal.

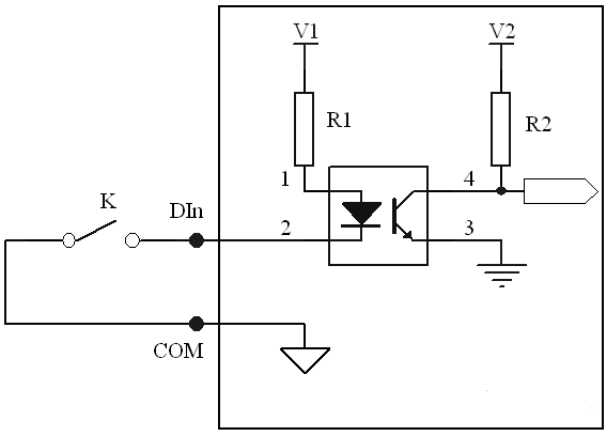

Figure 3-2 Circuit Diagram of Binary Input Interface

Relay Output Interface

This product is provided with two relay outputs interfaces for alarm indication or protection control output in many conditions. Electric parameter of internal relay: AC 250 V/DC 30 V, 3 A.

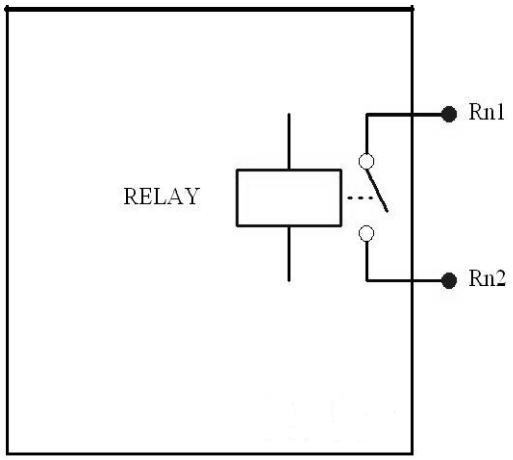

Figure 3-3 Circuit Diagram of Relay Output Interface

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4.1 Full-screen Display

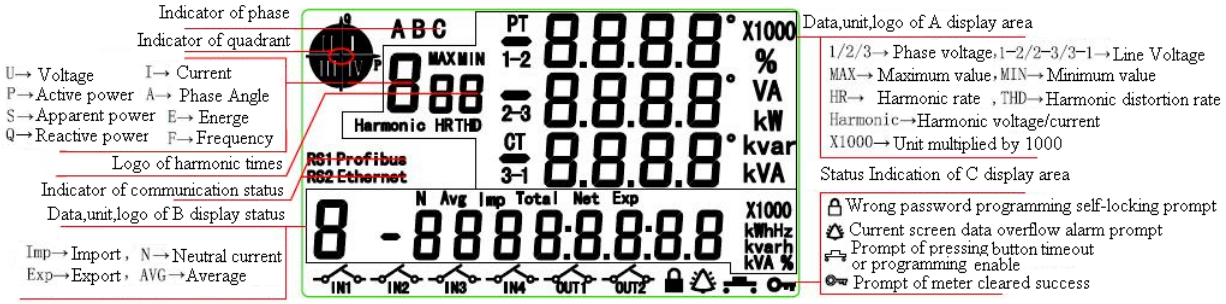


Figure 4-1 Description of LCD Indication

4.2 Cyclic Display

Key Functions at Cyclic Display Mode

Key symbol	▲	▼	↵	⇄
Function	Switching from cyclic display to buttom display		Lock/unlock blinking display	Switching between display areas A and B (blinking prompt)

Screen Lock in Cyclic Display State

Data in display area A or B can be locked in cyclic display state to enable long-time monitoring of data in certain area.

Steps: press "⇄", select the desired display area (target data will blink thrice), and press "↵" to lock, and vice versa for unlocking.

Cyclic Display Parameter

Duration: 1 to 99 sec., configurable;

Number of items: to be defined with one byte. 4 high 4 bits are number of items in display area A while 4 low 4 bits are number of items in display area B. 16 items are acceptable to each area. At any time, display area A and display area B should have at least one cyclic display item.

Cyclic Display State

Cyclic display data in areas A and B can be defined by user. User may develop cyclic display scheme previously through inquiring "Code list of optional settings in areas A and B".

Code list of optional settings in area A:

Data item	Data type (current value)		
	Transient	Maximun	Minimum
Phase voltage	0	1	2
Line voltage	3	4	5
Current	6	7	8
Neutral current	9	10	11

Data item	Data type (current value)		
	Transient	Maximun	Minimum
Active power	12	13	14
Reactive power	15	16	17
Apparent power	18	19	20
Power factor	21	/	/
Phase angle	22	/	/

Code list of optional settings in area B:

Data item	Data type (current value)			Data item	Data			
	Tran-sient	Maximun	Minimum		Current month	Phase L1	Phase L2	Phase L3
Average phase voltage	228	229	230	Import active power	251	252	253	254
Average line voltage	231	232	233	Export active power	255	256	257	258
Average current	234	235	236	Total active power	259	260	261	262
Neutral current	237	238	239	Net active power	263	264	265	266
Total active power	240	241	242	Impot reactive power	267	268	269	270
Total reactive power	243	244	245	Export reactive power	271	272	273	274
Total apparent power	246	247	248	Total reactive power	275	276	277	278
Total power factor	249	/	/	Net reactive power	279	280	281	282
Frequency	250	/						
Error code	283	/						

Note

In flip-with-key state or parameter-set-with-key state, this product will automatically return to cyclic display state if no key operation within defined duration.

4.3 Key Definition

Key Functions at Flip-With-Key Display Mode

Key symbol	▲	▼	↵	↵
Function	1) Switch from cyclic display state to key display state through pressing "▲" or "▼". 2) Flip over to previous screen with "▲" and to next screen with "▼".		Enter next menu	1) Switch between A (multi-line) and B (single line) display areas 2) Return to previous menu

Data Item of Key Display

- Data items displayed in area A (mainly measuring data)

Level 1	**Level 2**
Voltage (1)	Extreme value
Line voltage (2)	Extreme value
Current (3)	Extreme value
Neutral current (4)	Extreme value
Active power (5)	Extreme value
Reactive power (6)	Extreme value
Apparent power (7)	Extreme value
Power factor (8)	/
Phase angle (9)	/
PT and CT ratio (10)	/

- Data items displayed in area B (mainly measuring data)

		Import active	Export active	Total active	Net active	Import reactive	Export reactive	Total reactive	Net reactive
Electric energy	Total	(01)	(05)	(09)	(13)	(17)	(21)	(25)	(29)
	Phase A	(02)	(06)	(10)	(14)	(18)	(22)	(26)	(30)
	Phase B	(03)	(07)	(11)	(15)	(19)	(23)	(27)	(31)
	Phase C	(04)	(08)	(12)	(16)	(20)	(24)	(28)	(32)
Frequency		(33)							
Version		(34)							
Active constant		(35)							
Reactive constant		(36)							
Device ID		(37)							
Error code		(38)							

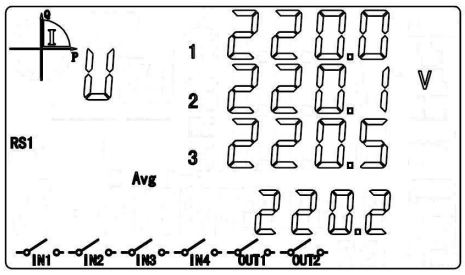
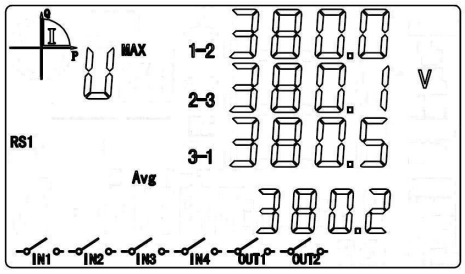
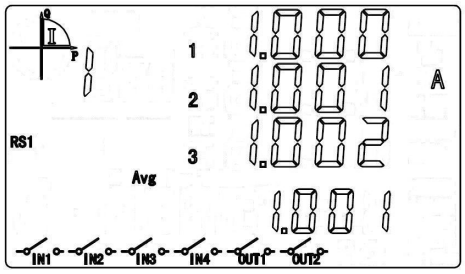
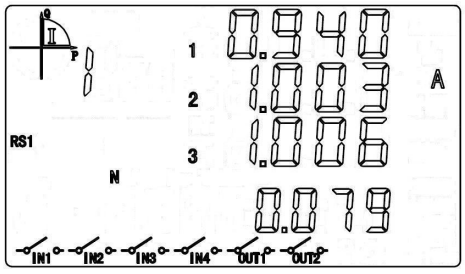
- Data items combined in area A and B:

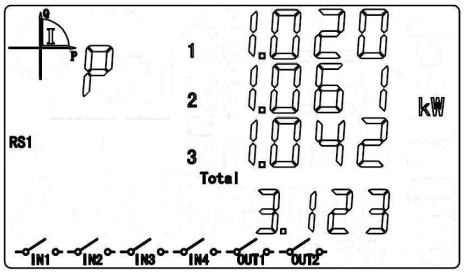
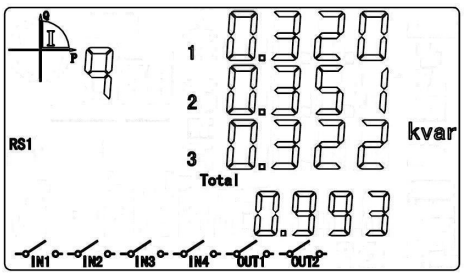
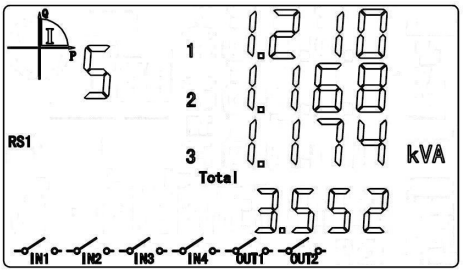
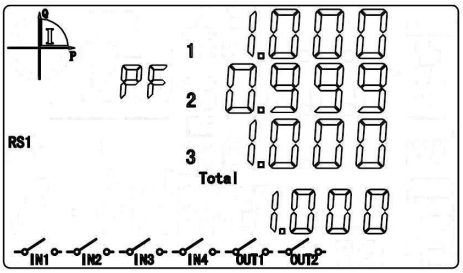
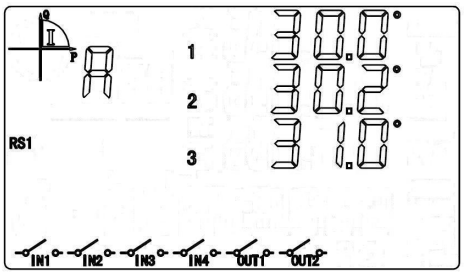
Firmware version number, Device ID, active constant and reactive constant.

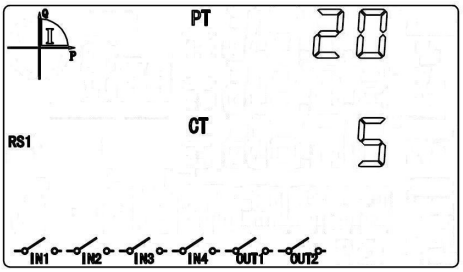
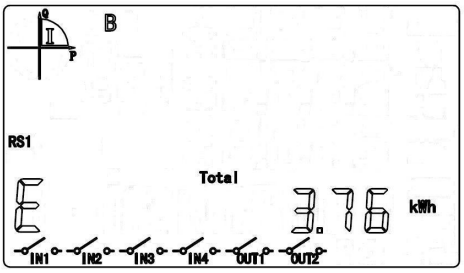
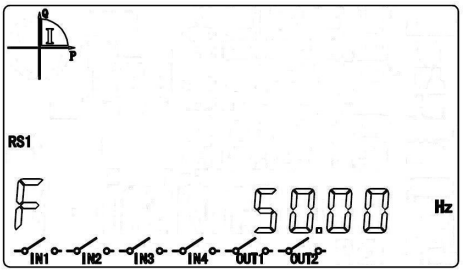
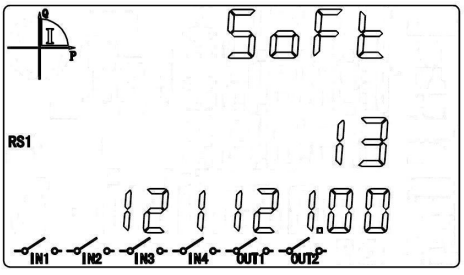
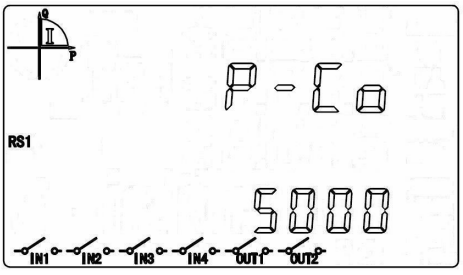
Note

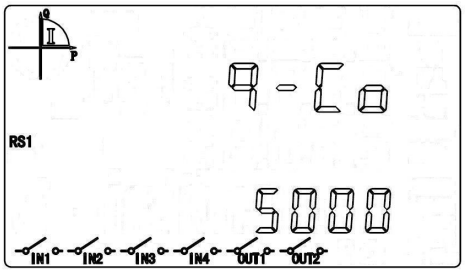
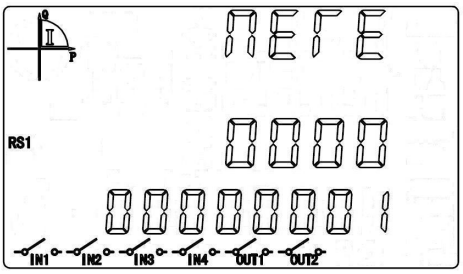
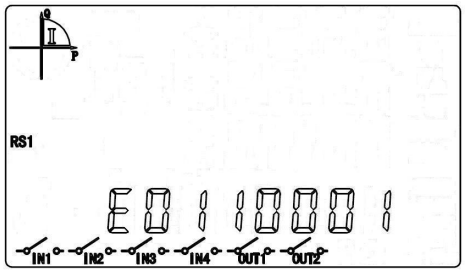
Full screen, firmware version number is displayed in order when the meter is power on.

Examples for Flip-With-Key Operation

	**Example 1:** This screen shows voltage items. At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" again to switch to voltage items. In the figure, L1=220.0 V, L2=220.1 V, L3=220.5 V and 3-phase average voltage=220.2 V. "RS1" shows there is one RS485 port and flickering symbol means communication in progress. " " means the meter runs in first quartile.
	**Example 2:** This screen shows maximum value display items of current line voltage. At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" again to switch to voltage items and press " " to enter maximum value display. In the figure: L1=380.0 V, L2=380.1 V, L3=380.5 V, and maximum 3-phase average line voltage=380.2 V. You can press "▲" or "▼" to switch to minimum line voltage display. Press " " to return to previous display.
	**Example 3:** This screen shows current items. At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to switch to phase current display. In the figure, L1=1.000 A, L2=1.001 A, L3=1.002 A and 3-phase average current=1.001 A.
	**Example 4:** This screen shows zero sequence current items. At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to enter zero sequence current display mode. In the figure, L1=0.940 A, L2=1.003 A, L3=1.006 A and zero sequence current=0.079 A.

	**Example 5:** This screen shows current active power items. At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to enter active power items. In the figure, L1=1.020 kW, L2=1.061 kW, L3=1.042 kW and total active power=3.123 kW.
	**Example 6:** This screen shows current reactive power items. At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to enter reactive power items. In the figure, L1=0.320 kvar, L2=0.351 kvar, L3=0.322 kvar and total reactive power=0.993 kvar.
	**Example 7:** This screen shows current apparent power items. At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to enter apparent power items. In the figure, L1=1.210 kVA, L2=1.168 kVA, L3=1.174 kVA and total apparent power=3.552 kVA.
	**Example 8:** This screen shows current power factor items. At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to enter power factor items. In the figure, L1=1.000, L2=0.999, L3=1.000 and total power factor=1.000.
	**Example 9:** This screen shows phase angle items. At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to enter phase angle items. In the figure, L1=30.0°, L2=30.2°, L3=31.0°.

	**Example 10:** This screen shows PT and CT ratio display items. At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to enter PT and CT ratio display items. In the figure, PT ratio=20.0, CT ratio=5.0. (Note: decimals part of ratio are not displayed.)
	**Example 11:** This screen shows current Phase B total active power items. At cyclic display mode, press "▲" or "▼" to enter key display mode, press " " to switch to area B, and press "▲" or "▼" to switch to current Phase B total active power items.
	**Example 12:** This screen shows frequency display items. At cyclic display mode, press "▲" or "▼" to enter key display mode, press " " to switch to area B, and press "▲" or "▼" to switch to frequency items, namely frequency value.
	**Example 13:** This screen shows display items of software version. At cyclic display mode, press "▲" or "▼" to enter key display mode. Press " " to switch to area B. Press "▲" or "▼" again to switch to display items of software version. In the figure, "Soft" means software version, "13" means product specification, "121121" means software version date and "00" means serial number of software production.
	**Example 14:** This screen shows active pulse constant items. At cyclic display mode, press "▲" or "▼" to enter key display mode, press " " to switch to area B, and press "▲" or "▼" to switch to active pulse constant items. In the figure, active constant=5,000 imp/kWh.

	**Example 15:** This screen shows reactive pulse constant items. At cyclic display mode, press "▲" or "▼" to enter key display mode, press " " to switch to area B, and press "▲" or "▼" to switch to reactive pulse constant items. In the figure, reactive constant=5,000 imp/kWh.
	**Example 16:** This screen shows Device ID display items. At cyclic display mode, press "▲" or "▼" to enter key display mode, press " " to switch to area B, and press "▲" or "▼" to switch to Device ID display items. Device ID=000000000001.
	**Example 17:** This screen shows error code display items. At cyclic display mode, press "▲" or "▼" to enter key display mode, press " " to switch to area B. Press "▲" or "▼" again to switch to fault code display items. "E" means fault prompt, the 7 bits from right to left mean respectively phase A loss, phase B loss, phase C loss, voltage phase inversion, phase C reverse, phase B reverse, and phase A reverse. For example, "E0110001" means phase B and phase C loss and phase C reverse fault occurs.

Key Setting Parameters

1. Key functions at parameter setting mode

Key symbol	▲	▼		
Function	a) "▲" to switch digit or flip over; b) "▼" to move cursor or flip over.		a) Press " " and " " at the same time to enter setting screen. b) Press " " to enter next menu or "confirm" parameter setting. c) Press " " to return to previous menu or "cancel" parameter setting [1].	

1.Press " " once after adjusting parameters with "▲" and "▼" to display "Sure", and press " " once again to alter parameters. Pressing " " immediately after "Sure" appears will cancel current alteration.

2. Data items configurable with key (Note 1)

NO.	1st level menu		2nd level menu			
	Symbol	Definition	Symbol	Definition	Range	Remarks
1	Conn	Communi-cation setting	bPS	Baud rate	600 ... 38400	Default setting: 2400
			PrY	Parity	8E1/8o1/8n1/8n2	Default setting: 8E1
			AdrS	Modbus address	0 ... 247	Default setting: 0
			dLAY	Modbus sending delay	0 ... 2999	Unit: ms Default setting: 10
			645H	DL/T645 high 6 address	0 ... 999999	Default setting: 0
			645L	DL/T645 low 6 address	0 ... 999999	Default setting: Last 3 digital of S/N
2	PrCr	Ratio setting (Note 2)	Pr-A	Voltage ratio integer part	0 ... 9999	Combination 0 ... 9999.9999 Default setting: 1
			Pr-b	Voltage ratio decimal part	0 ... 9999	
			Cr-A	Current ratio integer part	0 ... 9999	Combination 0 ... 9999.9999 Default setting: 1
			Cr-b	Current ratio decimal part	0 ... 9999	
3	SYS	System setting	tYPE	Connection	3P4L 3P3L_2CT 3P3L_3CT AUto	3phase4wire 3phase3wire -2CT 3phase3wire -3CT Automatic
			PASS	Password		6 bits in total, Set L0-2 password Default setting: 000000
4	CLr	Clearing extreme value	EtrE			
		Meter reset	ALL			

NO.	1st level menu		2nd level menu			
	Symbol	Definition	Symbol	Definition	Range	Remarks
5	dI SP	Display setting	PrES	Time of returning to cyclic display state when no operation	1 ... 99	Unit: min. Default setting: 10
			LI 9H	Time of backlight on when no operation (normally on when set to 0)	0 ... 99	Unit: min. Default setting: 10
			CYCL	Interval of cyclic display	1 ... 99	Unit: sec Default setting: 5

Note

Password level (1 bit, 0 to 2) and password (6 bits) should be entered at first for key setting. Password level and permission:

- L0 password-all parameters above are configurable;
- L1 password-all parameters above are configurable;
- L2 password-all parameters except for meter reset, clearing extreme value and PT/CT conversion ratio are configurable.

Note

The meter should be reset after altering PT/CT ratio to ensure reasonable correspondence between communication reading and displayed metering data.

3. Parameter setting with keys (take "Conn communication setting" for example)

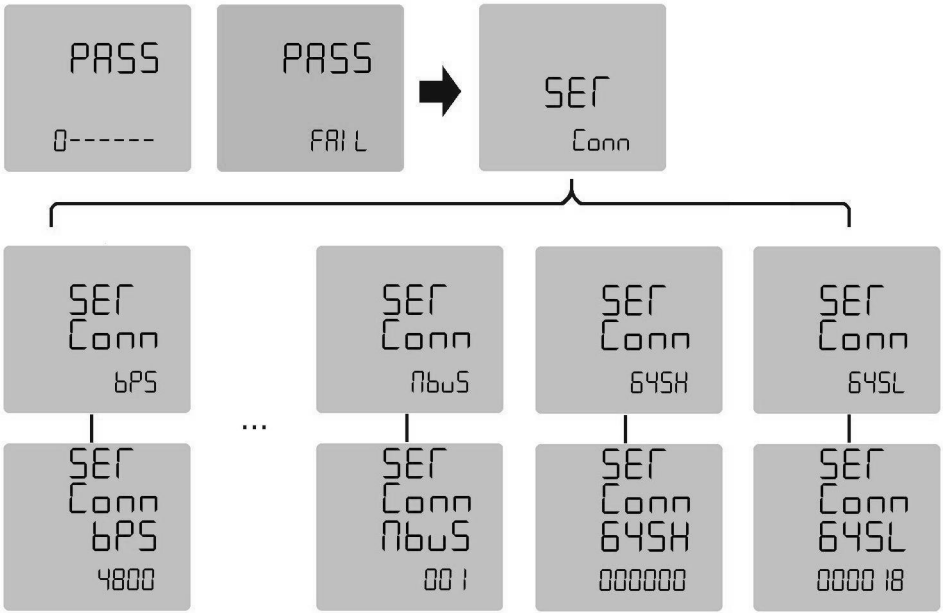


Figure 4-2 Parameter setting with keys

At any time, press " ↵ " and " ⮌ " simultaneously to enter "PASS" screen. The first digit of displayed data means password level and the remaining 6 data make up the password (press "▲" to change digits and "▼" to move cursor). Press " ↵ " to confirm. "FAIL" will appear if password level and password are wrong. To re-enter password, press " ↵ ". To quit and return to cyclic display state, enter " ⮌ " (if specified error count is reached, parameter setting function will be locked for certain period which is configurable in advance). If is password is validated, you may enter the first level menu. The figure shows the read-write items under "Conn" menu: baud rate and communication address of RS485 port can be set.

Note

"SURE" screen appears after selecting or inputting parameter and pressing " ↵ ". Press " ↵ " once again to activate new parameter. Pressing " ⮌ " at any time during parameter setting will cancel setting or return to previous menu.

■

Installation and Wiring 5

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5.1 Overall Dimension

The figure below shows the overall dimension of this product. Panel cut out size: 92 mm×92 mm

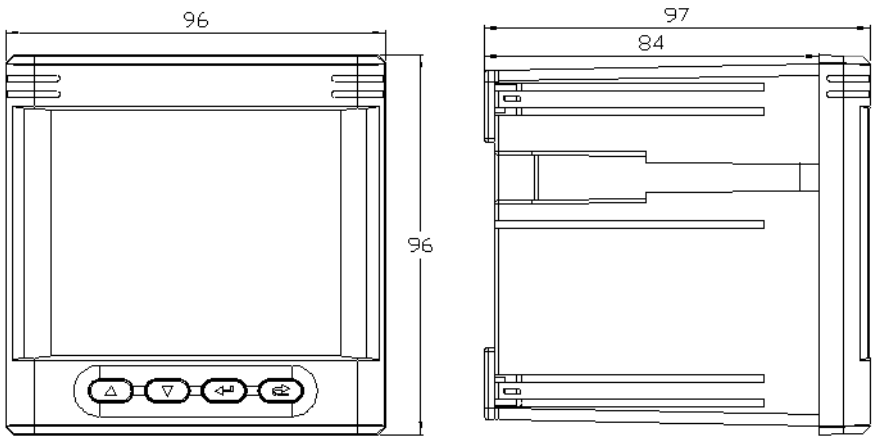

Figure 5-1 Overall Dimension of Instrument

5.2 Precautions of Installation

1. Dry and well ventilated environment far away from thermal source and strong electric (magnetic) field is recommended for installation of this product.
2. Ambient temperature: -25 ℃ to +60 ℃ , humidity: ≤ 95% (no condensation)
3. This product should be firmly mounted to avoid accident arising from vibration.
4. For the reason of convenient installation, maintenance and operation and safety, enough space around this product should be reserved during installation (especially when one panel for multiple meters).
5. Requirement for electric wiring: Stranded fire-retarded copper wire over 2.5 mm^2 should be used for current circuit, 1.5 mm^2 stranded fire-retarded copper wire should be used for voltage circuit and power supply circuit, and 1.0 mm^2 Shielded Twisted Pair should be used for RS485 communication.
6. Requirement for electric connection: In voltage input circuit and operating power supply circuit, appropriate fuses (such as 0.5 A fuse) should be connected and a CT short-circuit box should be provided to prevent open circuit of CT wiring.

5.3 Terminals and Wiring Diagram

Definition of Terminals (viewed from rear to front and from left to right)

1. Upper main terminals

V+	V-	NC	NC	R11	R12	R21	R22
Power supply		Reserved	Reserved	Relay output 1		Relay output 2	

Note

NC means no connection, the same below.

2. Lower main terminals

V1	V2	V3	VN	I11	I12	I21	I22	I31	I32
Phase A voltage	Phase B voltage	Phase C voltage	Neutral	Phase A current input	Phase A current output	Phase B current input	Phase B current output	Phase C current input	Phase C current output

Note

Main terminals are barrier terminals which can be connected using fork or ring type lug (no more than 6.5 mm wide). For cables to be connected to upper and lower main terminals, cold-pressed UT2.5-3 terminal is recommended before connection. The diagram of connection is below.

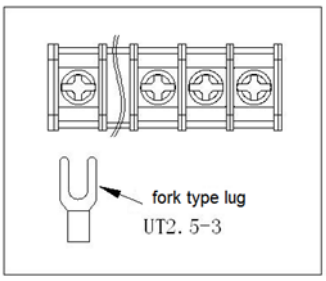

Figure 5-2 Connection Diagram of Main Terminal

3. Middle auxiliary terminal

P+	Q+	COM1	DI1	DI2	DI3	DI4	COM2	A	B	NC	NC
Active pulse output	Reactive pulse output	Common pulse output terminal	Binary input 1	Binary input 2	Binary input 3	Binary input 4	Common binary input terminal	RS485 +	RS485 -	Reserved	Reserved

Note

Auxiliary terminal is pluggable.

Wiring Diagram

Wiring diagram of main terminal is showed below. "V+" and "V-" are power supply terminals. This product supports DC/AC input, with input voltage 40 V to 420 V. For 3-phase-3-wire connection, V_n and V_2 should be subject to external pup joint, see Figure 5-5.

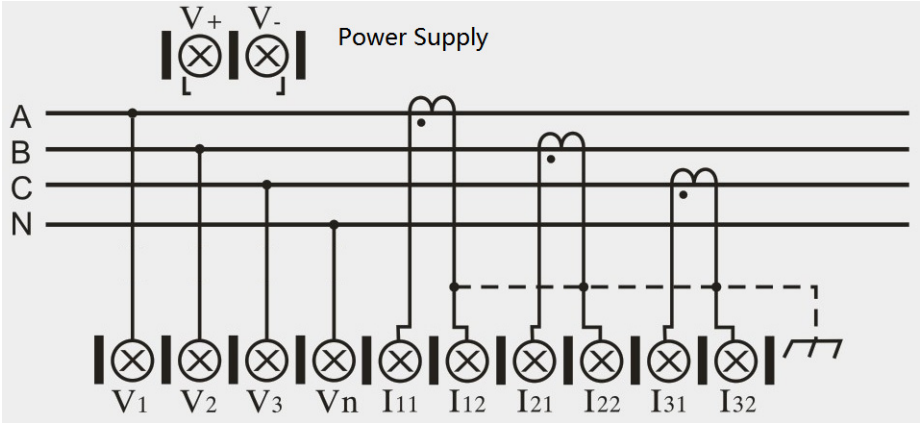

Figure 5-3 Wiring Diagram of 3-phase-4-wire (W/O PT)

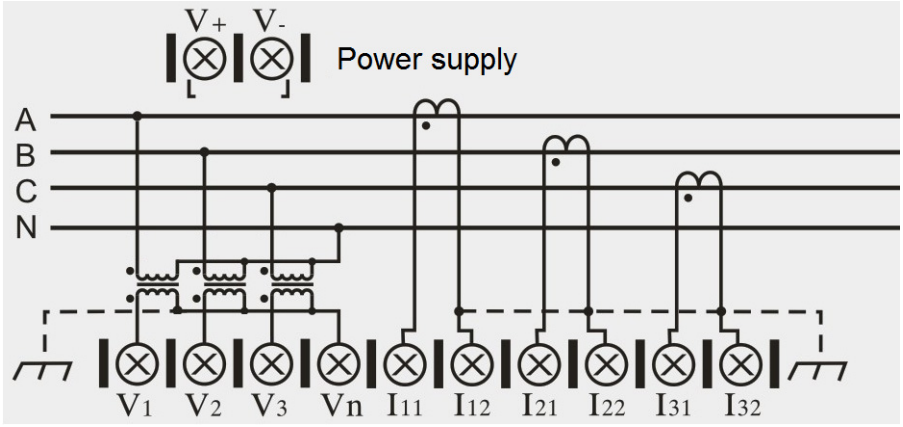

Figure 5-4 Wiring Diagram of 3-phase-4-wire (With PT)

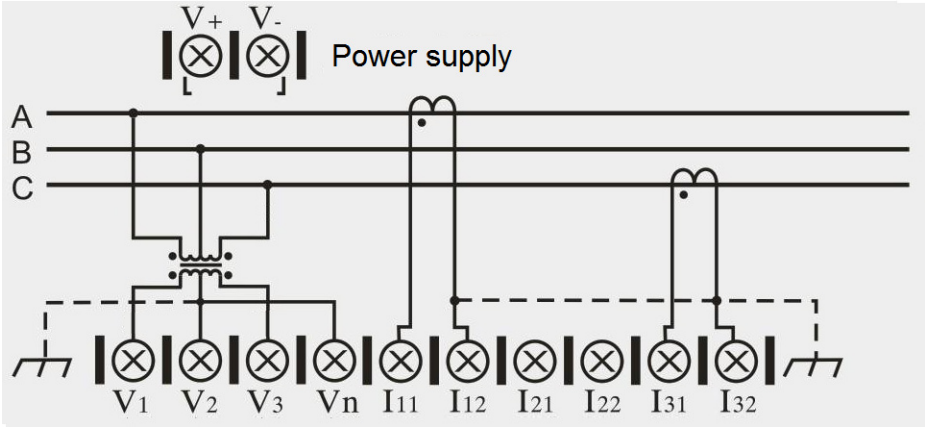

Figure 5-5 Wiring Diagram of 3-phase-3-wire

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Communication 6

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6.1 Use of Communication

RS485 port of this product supports MODBUS-RTU communication protocol. Even parity check is the default setting for data byte check, namely 8E1 (8 digit data, even parity check, 1 stop bit) format. MODBUS-RTU communication protocol can also be configured to odd parity check or no verification, namely 8O1 (8 digit data, odd parity check, 1 stop bit), 8N1 (8 digit data, no parity check, 1 stop bit), or 8N2 (8 digit data, no parity check, 2 stop bits) format. Baud rate of communication port could any of 600 bps, 1,200 bps, 2,400 bps, 4,800 bps, 9,600 bps, 19,200 bps and 38,400 bps.

RS485 port of this product should be connected using Shield Twisted Pair. When wiring, layout of the entire network should be considered: length and orientation of communication cable, position of upper computer, matched resistance at network end-point, communication converter, network scalability, network coverage, EMI, etc.

Note

1. Wiring should be conducted strictly in accordance with requirement.
2. The power meter requiring no communication temporarily should be connected to RS485 network for easy diagnosis and test.
3. The shielding layer side of cable connected with upper computer should be reliably earthed (PGND: ground, cubicle, cabinet, etc.) to avoid two-point or multi-point earthing.
4. Shield Twisted Pair should be used for RS485 bus cable. For two twisted pairs, different colors are recommended, one color for "A" side and another color for "B" side of 485 communication port.

6.2 Introduction of MODBUS-RTU Communication Protocol

6.2.1 Overview

Type of Protocol

This is MODBUS RTU protocol applicable to real-time communication of embedded electric energy meter. This protocol defines the data exchange between terminal unit (slave) and Master, which is realized in the form of RTU (remote terminal unit) of MODBUS. Asynchronous master-slave half-duplex communication is used. Communication is initiated from master and slave responds after receiving request from master. Communication response time < 0.2 sec.

Physical Layer

- Transmission interface: RS485
- Communication address: 0 to 247
- Communication baud rate: 600 bps to 38,400 bps
- Communication media: Shield Twisted Pair

Data Link Layer (DLL)

- Transmission manner: asynchronous master-slave half-duplex
- Data frame format: 1 start bit, 8 digit data, even parity check bit, 1 stop bit
- Data packet format:

Address	Function	Data	CRC
8 bits	8 bits	n*8 bits	16 bits

Data packet transmission sequence always uses identical address, function code, data and check code. Each data packet should be transmitted as a continuous bit stream. When data packet from the master reaches slave, slave matching the address field in data packet will receive and check the data. If no error, slave will execute the request in data packet and send the responsive date packet to the master. The data packet sent back by slave contains slave Address, Function executed, Data generated from function execution and CRC.

- Address

Address is at the beginning of data packet and consists of an 8-bit data which means slave address specified by the master. Each slave address in the bus is unique. Valid address range is from 0 to 247. After the master sends data packet, only slave matching the inquire address of the master will respond.

- Function

It describes which function is executed by slave. Meanings of all function codes are given below.

Code	Definition	Function
03 H	Read data	Read current binary value of one or more variables
10 H	Preset multiple registers	Overwrite values of several variables using specific binary value

- Data

It contains data required for executing specific function by slave or data acquired when slave responds inquiry of master. Content of these data may be address code or data.

- CRC

Check code is 16-bit check data formed in data transmission for CRC of master and slave. Various interferences exist in communication, so data transmitted during communication may change. CRC will avoid data distortion during responsive transmission of master and slave and improves security and efficiency of system. For formation rule of check code, see Annex 1.

6.2.2 Function of Application Layer

Read Data Command (function code 03 H)

- Down frame format

Communication address (0-247)	Function code (03 H)	High byte of start address of data	Low byte of start address of data	High byte of length of data	Low byte of length of data	Low byte of CRC	High byte of CRC

- Response frame format

Communication address (0-247)	Function code (03 H)	Number of bytes of data length	Content of data	Content of data	Content of data	Low byte of CRC	High byte of CRC

- Example
  - Down frame of 3-phase voltage data read

Device address	03 H	10 H	00 H	00 H	03 H	Low check	High check

  - Response frame

Device address	03 H	06 H	Data 1	Data 2	...	Low check	High check

Preset Multi-Register Command (function code 10 H)

- Down frame format

Device address 0-247	Function code (10 H)	High byte of start address of variable	Low byte of start address of variable	High byte of variable number	Low byte of variable number	Byte n of data	Byte 1 of data	Byte of data	Byte n of data	Low byte of CRC	High byte of CRC

- Response frame format

Device address 0-247	Function code (10 H)	High byte of start address of variable	Low byte of start address of variable	High byte of variable number	Low byte of variable number	Low byte of CRC	High byte of CRC

- Example
  - Down frame when PT conversion ratio is 1234.5678 (hexadecimal notation of 12345678: 00BC 614EH)

Device address	10 H	00 H	03 H	00 H	02 H	04 H	00 H	BC H	61 H	4E H	Low check	High check

  - Response frame

Device address	10 H	00 H	03 H	00 H	02 H	Low check	High check

Exception Response

- Exception response frame format

Communication address (0-247)	Function code (80 H+03 H) (80 H+10 H)	Exception code (XX H)	Low byte of CRC	High byte of CRC

- Example

  - Address data of illegal register read

Device address	03 H	XX H	XX H	00 H	01 H	Low check	High check

  - Response frame

Device address	83 H	02 H	Low check	High check

- Exception code of MODBUS

Code	Meaning
02 H	Illegal data address
03 H	Illegal data
10 H	No permission
11 H	Register length overflow

6.2.3 CRC Method

CRC contains 2 bytes, namely 16-bit binary system. CRC is calculated with transmitting device and placed at the tail of transmitted message. Receiving device recalculates CRC of message received and compares whether CRC derived matches the received one. If not, error may occur.

To calculate CRC, preset all 16-bit registers to 1. Then, process each 8-bit data message one by one. Only 8-bit data bit is used for CRC calculation and start bit and stop bit and parity check bit (if any) are not involved.

Steps of calculating CRC:

- Preset 16-bit register to hexadecimal FFFF (namely all to 1), and this register is called CRC register.
- Execute exclusive OR of low bytes of 1st 8-bit data and 16-bit CRC register and put the result in CRC register.
- Shift the content of register rightwards by one bit (towards lower bit) and fill the highest bit with 0. Check the lowest bit.
- If the lowest bit is 0, repeat step 3 (shift again); if it is 1, execute exclusive OR of CRC register and polynomial A001 (1010 0000 0000 0001).
- Repeat step 3 and step 4 until shift rightwards 8 times. Now, all 8-bit data are processed.
- Repeat step 2 to step 5 to process next 8-bit data.
- The CRC register derived finally is CRC.

6.2.4 Information mapping table

Common Parameters

Parameter	Address	Data Type	Length	R/W	Data Range	Remark
Modbus address	0000 H	unsigned int	2 bytes	R/W	0...247	
Baud rate of communication	0001 H	unsigned int	2 bytes	R/W	0...6	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps 4: 38400 bps 5: 600 bps 6: 1200 bps
High 16 bits of voltage ratio part	0002 H	unsigned long	4 bytes	R/W	0...99999999	PT ratio=set value/10,000, 10,000 as default when PT=0
Low 16 bits of voltage ratio part	0003 H					
High 16 bits of current ratio part	0004 H	unsigned long	4 bytes	R/W	0...99999999	CT ratio=set value/10,000, 10,000 as default when CT=0
Low 16 bits of current ratio part	0005 H					
Clearing extreme value	0006 H	unsigned int	2 bytes	W	Arbitrary value	
Parity	0020 H	unsigned int	2 bytes	R/W	0...3	0: 8E1 1: 8o1 2: 8n1 3: 8n2

Relay Alarm Parameters

Parameter	Address	Data Type	Length	R/W	Data Range	Remark
Relay output 1	0100 H	unsigned int	2 bytes	R/W	0...1	Write operation is valid when "alarm manner control byte" is 0 or 2
Relay output 2	0100 H	unsigned int	2 bytes	R/W	0...1	Write operation is valid when "alarm manner control byte" is 0 or 1
Binary inputs	0102 H	unsigned int	2 bytes	R		High byte: binary input status (note) Low byte: binary output status

Parameter		Address	Data Type	Length	R/W	Data Range	Remark
Alarm manner control byte		0103 H	unsigned int	2 bytes	R/W	0...3	0: turn off alarm function 1: relay output 1 is used for alarm 2: relay output 2 is used for alarm 3: output ports 1 and 2 are all used for alarm
Alarm status byte		0106 H	unsigned int	2 bytes	R	0...0x3F	From low to high, each bit means status of an alarm group: 0: no alarm activated 1: in alarm status
Alarm 1	Limit violation data type	0110 H	unsigned int	2 bytes	R/W	0...31	See alarm type table
	High 16 bits of limit violation threshold	0111 H	unsigned long	4 bytes	R/W	Arbitrary value	Threshold=set value/100
	Low 16 bits of limit violation threshold	0112 H					
	Limit violation detection type	0113 H	unsigned int	2 bytes	R/W	0...1	0: over, 1: below
	Alarm port	0114 H	unsigned int	2 bytes	R/W	0...3	0: off 1: alarm output to relay output 1 2: alarm output to relay output 2 3: alarm output to output ports 1 and 2
Alarm 2		0115 H ...0119 H		10 bytes	R/W		See Alarm 1
Alarm 3		011A H ...011E H		10 bytes	R/W		See Alarm 1
Alarm 4		011F H ...0123 H		10 bytes	R/W		See Alarm 1
Alarm 5		0124 H ...0128 H		10 bytes	R/W		See Alarm 1
Alarm 6		0129 H ...012D H		10 bytes	R/W		See Alarm 1

Note

High bytes BIT0-BIT3 respectively mean status of binary input 1 to 4. Bit value 0 means input is open while 1 means input is closed.

Low bytes BIT0 and BIT1 respectively mean status of relay output 1 and 2. Bit value 0 means contact is open (relay no operation) while 1 means contact is closed (relay closed).

Other Parameters

Parameter	Address	Data Type	Length	R/W	Data Range	Remark
Voltage specification	0134 H	unsigned int	2 bytes	R/W	0...3	3-phase-3-wire 0: 100 V; 3: 380 V; 3-phase-4-wire 1: 220 V; 2: 57.7 V;
Cyclic display time	0132 H	unsigned int	2 bytes	R/W	1...99	Unit: sec
Number of cyclic display items	0133 H	unsigned int	2 bytes	R/W	0...0xFF	See description of cyclic display parameters
1st screen of cyclic display item of screen A	0140 H	unsigned int	2 bytes	R/W	0...999	See cyclic display code table of area A
Number n screen of cyclic display item of screen A	...	unsigned int	2 bytes	R/W	0...999	
16th screen of cyclic display item of screen A	014F H	unsigned int	2 bytes	R/W	0...999	
1st screen of cyclic display item of screen B	0150 H	unsigned int	2 bytes	R/W	0...999	See cyclic display code table of area B
Number n screen of cyclic display item of screen B	...	unsigned int	2 bytes	R/W	0...999	
16th screen of cyclic display item of screen B	015F H	unsigned int	2 bytes	R/W	0...999	

Instantaneous Such as Voltage, Current, Active/Reactive and Apparent Power, Power Factor, and Frequency

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Phase A voltage	1000 H	unsigned int	2 bytes	R	0...65535	0.01 V
Phase B voltage	1001 H	unsigned int	2 bytes	R	0...65535	0.01 V
Phase C voltage	1002 H	unsigned int	2 bytes	R	0...65535	0.01 V
Average phase voltage	1003 H	unsigned int	2 bytes	R	0...65535	0.01 V
Uab line voltage	1004 H	unsigned int	2 bytes	R	0...65535	0.01 V
Ubc line voltage	1005 H	unsigned int	2 bytes	R	0...65535	0.01 V
Uca line voltage	1006 H	unsigned int	2 bytes	R	0...65535	0.01 V
Average line voltage	1007 H	unsigned int	2 bytes	R	0...65535	0.01 V
Phase A current	1008 H	unsigned int	2 bytes	R	0...65535	0.001 A
Phase B current	1009 H	unsigned int	2 bytes	R	0...65535	0.001 A
Phase C current	100A H	unsigned int	2 bytes	R	0...65535	0.001 A
Average current	100B H	unsigned int	2 bytes	R	0...65535	0.001 A
Neutral current	100C H	unsigned int	2 bytes	R	0...65535	0.001 A
Phase A active power	100D H	signed int	2 bytes	R	-32767...32767	1 W
Phase B active power	100E H	signed int	2 bytes	R	-32767...32767	1 W
Phase C active power	100F H	signed int	2 bytes	R	-32767...32767	1 W
Total active power	1010 H	signed int	2 bytes	R	-32767...32767	1 W
Phase A reactive power	1011 H	signed int	2 bytes	R	-32767...32767	1 var

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Phase B reactive power	1012 H	signed int	2 bytes	R	-32767...32767	1 var
Phase C reactive power	1013 H	signed int	2 bytes	R	-32767...32767	1 var
Total reactive power	1014 H	signed int	2 bytes	R	-32767...32767	1 var
Phase A apparent power	1015 H	signed int	2 bytes	R	-32767...32767	1 VA
Phase B apparent power	1016 H	signed int	2 bytes	R	-32767...32767	1 VA
Phase C apparent power	1017 H	signed int	2 bytes	R	-32767...32767	1 VA
Total apparent power	1018 H	signed int	2 bytes	R	-32767...32767	1 VA
Phase A power factor	1019 H	signed int	2 bytes	R	-1000...1000	0.001
Phase B power factor	101A H	signed int	2 bytes	R	-1000...1000	0.001
Phase C power factor	101B H	signed int	2 bytes	R	-1000...1000	0.001
Total power factor	101C H	signed int	2 bytes	R	-1000...1000	0.001
Frequency	101D H	unsigned int	2 bytes	R	0...65535	0.01 Hz
Phase A angle	1023 H	unsigned int	2 bytes	R	0...3600	0.1
Phase B angle	1024 H	unsigned int	2 bytes	R	0...3600	0.1
Phase C angle	1025 H	unsigned int	2 bytes	R	0...3600	0.1

Power Parameters

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Phase A import active power high 16 bits	2000 H	unsigned long	4 bytes	R	0...4294967295	0.1 Wh
Phase A import active power low 16 bits	2001 H					
Phase B import active power high 16 bits	2002 H	unsigned long	4 bytes	R	0...4294967295	0.1 Wh
Phase B import active power low 16 bits	2003 H					
Phase C import active power high 16 bits	2004 H	unsigned long	4 bytes	R	0...4294967295	0.1 Wh
Phase C import active power low 16 bits	2005 H					
Total import active power high 16 bits	2006 H	unsigned long	4 bytes	R	0...4294967295	0.1 Wh
Total import active power low 16 bits	2007 H					
Phase A import reactive power high 16 bits	2008 H	unsigned long	4 bytes	R	0...4294967295	0.1 varh
Phase A import reactive power low 16 bits	2009 H					
Phase B import reactive power high 16 bits	200A H	unsigned long	4 bytes	R	0...4294967295	0.1 varh
Phase B import reactive power low 16 bits	200B H					
Phase C import reactive power high 16 bits	200C H	unsigned long	4 bytes	R	0...4294967295	0.1 varh
Phase C import reactive power low 16 bits	200D H					

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Total import reactive power high 16 bits	200E H	unsigned long	4 bytes	R	0...4294967295	0.1 varh
Total import reactive power low 16 bits	200F H					
Phase A export active power high 16 bits	2100 H	unsigned long	4 bytes	R	0...4294967295	0.1 Wh
Phase A export active power low 16 bits	2101 H					
Phase B export active power high 16 bits	2102 H	unsigned long	4 bytes	R	0...4294967295	0.1 Wh
Phase B export active power low 16 bits	2103 H					
Phase C export active power high 16 bits	2104 H	unsigned long	4 bytes	R	0...4294967295	0.1 Wh
Phase C export active power low 16 bits	2105 H					
Total export active power high 16 bits	2106 H	unsigned long	4 bytes	R	0...4294967295	0.1 Wh
Total export active power low 16 bits	2107 H					
Phase A export reactive power high 16 bits	2108 H	unsigned long	4 bytes	R	0...4294967295	0.1 varh
Phase A export reactive power low 16 bits	2109 H					
Phase B export reactive power high 16 bits	210A H	unsigned long	4 bytes	R	0...4294967295	0.1 varh
Phase B export reactive power low 16 bits	210B H					
Phase C export reactive power high 16 bits	210C H	unsigned long	4 bytes	R	0...4294967295	0.1 varh
Phase C export reactive power low 16 bits	210D H					
Total export reactive power high 16 bits	210E H	unsigned long	4 bytes	R	0...4294967295	0.1 varh
Total export reactive power low 16 bits	210F H					

Extreme Value Parameters

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Phase A voltage	4X00	unsigned int	2 bytes	R	0...65535	0.01 V
Phase B voltage	4X07	unsigned int			0...65535	
Phase C voltage	4X0E	unsigned int			0...65535	
Uab line voltage	4X15	unsigned int			0...65535	
Ubc line voltage	4X1C	unsigned int			0...65535	
Uca line voltage	4X23	unsigned int			0...65535	
Phase A current	4X2A	unsigned int			0...65535	0.001 A
Phase B current	4X31	unsigned int			0...65535	
Phase C current	4X38	unsigned int			0...65535	
Neutral current	4X3F	unsigned int			0...65535	
Phase A active power	4X46	unsigned int			0...65535	1 W

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Phase B active power	4X4D	unsigned int			0...65535	
Phase C active power	4X54	unsigned int			0...65535	
Total active power	4X5B	unsigned int			0...65535	
Phase A reactive power	4X62	unsigned int			0...65535	1 var
Phase B reactive power	4X69	unsigned int			0...65535	
Phase C reactive power	4X70	unsigned int			0...65535	
Total reactive power	4X77	unsigned int			0...65535	
Phase A apparent power	4X7E	unsigned int			0...65535	1 VA
Phase B apparent power	4X85	unsigned int			0...65535	
Phase C apparent power	4X8C	unsigned int			0...65535	
Total apparent power	4X93	unsigned int			0...65535	

Note

X-0 means maximum value while X=1 means minimum value.

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Maintenance 7

7.1	Overview	54

7.1 Overview

- Voltage connection should be conducted strictly in accordance with voltage level marked on nameplate.
- Tighten the terminals and hang the meter securely to screen which is strong, refractory and vibration-free during installation. Upward view of the meter provides the best display effect, so it should be installed vertically.
- The meter should be stored in environment free of condensation at -35 ℃ to 70 ℃ and ≤ 95% humidity in original package. At most 5 layers are allowable for stacking. The meter is inappropriate for storing after unpacking. The meter should be stored in clean location free of hazardous substances or gas which may cause corrosion in air.
- In the operating environment of the meter, lightning protection should be provided.

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Ordering Number 8

8.1	Ordering Number	56

8.1 Ordering Number

Model:	**SICAM**	—	**P**	**3**	
Function					
3U, 3I, P, Q, PF, f, kwh, kVarh, 2 pulse, 1*RS485					**5**
3U, 3I, P, Q, PF, f, kwh, kVarh, 2 pulse, 4BI, 2BO, 1*RS485					**6**

Model	Ordering No.
SICAM P35	7KG7331-1BA01
SICAM P36	7KG7331-1BA11

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